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Abstract

We estimate and decompose family income-related inequality in child health in the US and analyze its dynamics using the income-related health mobility index recently introduced by Allanson et al., 2010. Data come from the 1997, 2002, and 2007 waves of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The findings show that family income-related child health inequality remains stable from early childhood into adolescence. The main factor underlying income-related child health inequality is family income itself, although other factors, such as maternal education, also play a role. Decomposition of income-related health mobility indicates that health changes over time are more favorable to children with lower initial family incomes vs. children with higher initial family incomes. However, offsetting this effect, our findings also suggest that as children grow up, changes in family income ranking over time are related to children's subsequent health status.

JEL-Code: I100, I120, I190.

Keywords: inequality, child health, income-related health inequality, income-related health mobility, health inequality.

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INTRODUCTION

There is a large and growing literature in economics that focuses on estimating and decomposing the sources of SES-related inequality in health, and examining how SES-related health inequality evolves over time. Most recent work employs the concentration index (CI), which captures the degree to which inequality in a health outcome measure is associated with inequality in a measure of SES, typically income (van Doorslaer et al., 2000). An important advantage of the CI is that it can be decomposed into a weighted sum of the CIs corresponding to the determinants of health (e.g., age, education), in which each weight represents the elasticity of health with respect to a particular determinant of health evaluated at the sample mean (Wagstaff et al., 2003). The CI is also useful when longitudinal data are available, since the change in the CI over time can be decomposed to provide information regarding whether the health of the poor is improving or worsening over time relative to that of the rich (Allanson et al., 2010).

In this study, we estimate and decompose family income-related inequality in child health, and analyze its dynamics, using data from the 1997, 2002, and 2007 waves of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). Recent studies document a positive relationship between family income and child health, with some studies reporting that this so-called "family-income child health gradient" becomes more pronounced as children get older.[1] The main empirical approach used in prior literature on the family income-child health gradient is to estimate a regression model in which a measure of child health is the dependent variable, and the independent variables include family income and a range of other demographic and family background characteristics. The estimated coefficients

[1] Recent studies in this area include: Case, Lubotsky, & Paxson, 2002; J. Currie & Stabile, 2003; Propper, Rigg, & Burgess, 2007; A. Currie, Shields, & Price, 2007; Condliffe & Link, 2008; Murasko, 2008; Khanam, Nghiem, & Connelly, 2009.

on family income and its interactions with other variables (e.g., child age, prior health shocks) are of primary interest.

In the present study, we add to this literature by examining the entire distribution of child health by family income. Our objectives are: (1) to use the CI to study how child health is spread out across the family income distribution in the US, and identify the main sources of family income-related inequality in child health; and (2) to apply the income-related health mobility index recently introduced by Allanson et al., 2010 to examine how income-related health inequality in child health evolves as young children grow up and enter adolescence.

DATA AND METHODS

Data come from wave I (1997), wave II (2002), and wave III (2007) of the CDS-PSID and the PSID family history files. The CDS-I includes 3,563 children 0 to 12 years old. In the CDS-II, 2,907 of these children were interviewed a second time, and in the CDS-III, 1,506 of the original respondents were interviewed a third time. We limit our sample to 7,262 child observations in which the mother is either the head of the household or the wife of the head. After limiting the sample to observations with complete data and non-zero sampling weights, our main analytic sample includes 6,166 observations.[2] The concentration indices and mobility indices discussed below are calculated using sample weights.

To measure child health, we use parent-reported health (PRH), which is the primary caregiver's response to the following question - ""In general, would you say (CHILD'S) health is

[2] We dropped observations with missing values on: race (15), gender (192), birth weight (29), family income (1), rural/urban location (136), smoking in family unit (5), health insurance (4), mother's education (334), mother's employment (39), analysis weight (99); finally we exclude the children in the CDS-II and CDS-III sample that are not in CDS-I for the purpose of longitudinal analysis of CI and MI, a total of another 242 observations.

excellent, very good, good, fair, or poor?" In the CDS data, PRH is coded from 1 to 5, with 1 representing excellent health and 5 representing poor health. In our analyses, we re-code this variable as: 1 (poor), 2 (fair), 3 (good), 4 (very good), and 5 (excellent). Information on family income comes from the 1997, 2003, and 2007 main PSID family files, and includes taxable income, transfer income, and social security income of all family unit members. Family income is deflated to 1996 dollars. Since we use the log of family income in our analyses, negative and zero values of family income are coded as one dollar.

In our analyses of income-related child health inequality, we use predicted child health. This prediction is generated from a random effect ordered probit model in which the variable PRH is regressed on child characteristics (i.e., child age, race/ethnicity), family background characteristics (i.e. family income, parental education), and objective measures of child health (i.e. low birth weight). These variables are included in the vector of covariates **w,** which are the determinants into which we decompose the concentration index.[3] We rescale the predicted value of child health into the [0, 1] interval as follows: $h_{it} = (\hat{h}^*_{it} - \hat{h}^*_{\min}) / (\hat{h}^*_{\max} - \hat{h}^*_{\min})$, where $\hat{h}^*_{\max}$ and $\hat{h}^*_{\min}$ are the maximum and minimum of the predicted quality of health, respectively.

Using h_{it}, we measure income-related health inequality using the CI (Wagstaff, Paci, & van Doorslaer, 1991). The standard deviation is calculated using the method given by Kakwani et al (1997). The CI is then decomposed into its determinants as demonstrated by Wagstaff at al. (2003). Then, we use the income-related health mobility index (MI) proposed by Allanson et.al (2010) to decompose the change in the cross-sectional CI from the starting period s (CI^s, the CI calculated using CDS I) to the final period f (CI^f, the CI calculated using either CDS II or CDS III), into two components M^R and M^H (Equation 1) (see Allanson et al. 2010 for a detailed

[3] See notes to Table 1 for a list of all the covariates included in the vector **w**.

discussion of the approach). In equation 1 below, CI^{fs} denotes the concentration index of the final period health ranked by starting period income.

$$CI^{f} - CI^{s} = \left(CI^{f} - CI^{fs}\right) - \left(CI^{s} - CI^{fs}\right) = M^{R} - M^{H} \qquad (1)$$

In equation 1, M^R measures the change in the CI over time that is due to the change in the income-ranking ("health-related income mobility"), and M^H captures the change due to the change in the level of child health itself ("income-related health mobility"). The term M^H is positive if changes in health over time favor the poor, is negative if health changes favor the rich, and is equal to zero if relative health changes are independent of income or health does not change. Furthermore, M^H can be decomposed into two parts (Allanson et.al., 2010),

$$M^{H} = CI^{s} - CI^{fs} = \left(CI^{s} - CI^{\Delta s}\right)\left(\frac{\overline{\Delta h}}{\bar{h}^{f}}\right) = Pq \qquad (2)$$

where $CI^{\Delta s}$ is the concentration index of health changes ranked by initial period income, and $\overline{\Delta h} = \bar{h}^{f} - \bar{h}^{s}$ is the average health changes between the starting and final periods (Equation 2). The term $P = \left(CI^{s} - CI^{\Delta s}\right)$ is called the progressivity index, and $q = \frac{\overline{\Delta h}}{\bar{h}^{f}}$ is called the scale factor.

RESULTS

Weighted summary statistics, and results from the random effects ordered probit model are available in Chatterji, Lahiri & Song (2011). The cross-sectional concentration index is 0.107 for CDS-I, 0.097 for CDS-II, and 0.107 for CDS-III (Table 1). All of the concentration index estimates are positive and statistically significantly different from zero, indicating that

family-income related child health inequality in the US begins early and persists as children grow up and enter adolescence.

In Table 1, for each CDS wave, we examine the relative importance of the social determinants of income-related child health inequality. Several findings are notable in Table 2. First, in all waves, family income contributes more than 30 percent to income-related child health inequality. This is consistent with prior research on adult health. (Lahiri & Pulungan, 2006; van Doorslaer & Jones, 2003). Second, maternal college education is highly unequal between the rich and the poor (C_{kt} is relatively large), and child health is responsive to this maternal education level (ξ_{kt} is relatively large). Third, in all waves, race/ethnicity and family structure are important factors underlying income-related child health inequality. Fourth, low birth weight contributes to income-related child health inequality only to a small degree, but it is notable that its effects persist into the CDS-III, when most respondents have entered adolescence and young adulthood.

In Table 2, we decompose the change in the CI across CDS waves into M^H (income-related health mobility) and M^R (health-related income mobility), and then further decompose M^H into the progressivity index P and the scale factor q to examine the reasons behind income-related health mobility (Allanson et al., 2010). The positive M^H for CDS-I to CDS-II and CDS-I to CDS-III implies that the relative health changes ranked by children's initial level of family income had the effect of reducing family-income related inequality in child health. Further decomposition of M^H shows that the progressivity index P is relatively large compared to the scale factor q (Table 2). The large P indicates that progressive income-related health mobility is driven by improvements in health over time that favor children who are relatively poor in the initial income ranking, especially between CDS-I and CDS-III. The scale factor q shows,

however, that average child health across all income groups improved only slightly over time, thus diminishing the effect of the large *P* on income related health mobility.

Health related income mobility (M^R) is positive, indicating that CDS III family income is more correlated with CDS III health than is CDS I family income (Table 2). In other words, children who moved up the income ranking over time were ultimately relatively healthier in the CDS III than those who moved down the income ranking over time. This effect counter-balances the progressive effect of income related health mobility on income-related child health inequality, leading to the result that there is virtually no change in the CI over time. In sum, our results show that income-related child health inequality does not change across the three CDS waves, despite a large, positive progressivity index (P), because: (1) children whose families move up the income ranking over time are ultimately relatively healthier; and (2) the large P cannot have much effect because, on average, child health is improving slowly over time.

CONCLUSION

Reducing disparities in child health is a major goal of US public health policy. Our study of a nationally representative, longitudinal sample of U. S. children shows that family income-related child health inequality remains stable from early childhood into adolescence. The major reason underlying income-related health inequality of children is family income itself, although other factors, such as maternal education, also play a role. Decomposition of income-related health mobility indicates that health changes over time are more favorable to children with lower initial family incomes vs. children with higher initial family incomes. This may be because low-income children are able to recover from early health shocks, such as low birth weight, and quickly accumulate health relative to higher-income children. However, our findings also

suggest that as children grow up, the income of families with children in poor health increases relatively slowly compared to that of families with healthy children such that changes in family income ranking over time are positively correlated with changes in children's relative health status. The mechanisms are unclear, but it is possible that lower income ranking may lead to reduced access to healthy environments (e.g. healthful food, clean living environments) and/or worse access to quality medical care for chronic conditions (e.g. asthma treatments), harming the relative health of children. It also is possible that families with children in poor health fall in the income ranking over time compared to families with healthy children.

As a whole, our findings suggest that to reduce income-related child health disparities in the US, public policy should focus not just on buffering the effects of early disadvantage on child health but also on protecting children from declining income rank, perhaps through policies that reduce disruptions in health insurance and housing that may accompany decline in income rank. Future research should focus on identifying such mechanisms, and understanding how policies can be best targeted to reduce income-related inequality in child health.

References

Allanson P, Gerdtham U, and Petrie D. 2010. Longitudinal Analysis of Income-related Health Inequality. *Journal of Health Economics* **29**: 78-86.

Case A; Lubotsky D, Paxson C. 2002. Economic Status and Health in Childhood: The Origins of the Gradient. *The American Economic Review* **92**: 1308-1334.

Chatterji P, Lahiri K, Song J. 2011. The dynamics of income-related health inequality among US children. *Working paper*, University at Albany.

Condliffe S, Link C. 2008. The Relationship between Economic Status and Child Health: Evidence from the United States. *American Economic Review* **98**: 1605-1618.

Currie A, Shields M, Price S. 2007. The Child Health/Family Income Gradient: Evidence from England. *Journal of Health Economics* **26**: 213-232.

Currie J, Stabile M. 2006. Child Mental Health And Human Capital Accumulation: The Case of ADHD. *Journal of Health Economics* **25**: 1094-1118.

Currie J, Stabile M. 2003. Socioeconomic Status and Child Health: Why Is the Relationship Stronger for Older Children?. *The American Economic Review* **93**: 1813-1823.

Kakwani N, Wagstaff A, van Doorslaer E. 1997. Socioeconomic Inequalities in Health: Measurement, Computation, and Statistical Inference. *Journal of Econometrics* **77**: 87-103.

Khanam R, Nghiem H, Connelly L. 2009. Child Health and the Income Gradient: Evidence from Australia. *Journal of Health Economics* **28**: 805-817.

Lahiri K, Pulungan Z. 2006. Income-related Health Disparity and Its Determinants in New York States: Racial/Ethnic and Geographical Comparisons. In Barbara C. Wallace (ed.) *Toward Equity in Health: A New Global Approach to Health Disparities.* New York: Springer Publishing Company, LLC.

Murasko J. 2008. An Evaluation of the Age-Profile in the Relationship between Household Income and the Health of Children in the United States. *Journal of Health Economics* **27**: 1489-1502.

Propper C, Rigg J, Burgess S. 2007. Child Health: Evidence on The Roles of Family Income and Maternal Mental Health from a UK Birth Cohort. *Health Economics* **16**: 1245-1269.

Van Doorslaer E et al. 2000. Equity in the Delivery of Health Care in Europe and the US. *Journal of Health Economics* **19**: 553-583.

Van Doorslaer E, Jones A. 2003. Inequalities in Self-reported Health: Validation of a New Approach to Measurement. *Journal of Health Economics* **22**: 61-87.

Van Doorslaer E, Koolman X, Jones, A. 2004. Explaining Income-related Inequalities in Doctor Utilisation in Europe. *Health Economics* **13**, 629–647.

Wagstaff A, Paci P, van Doorslaer E. 1991. On the Measurement of Inequalities in Health. *Social Science & Medicine* **33**: 545-557.

Wagstaff A, van Doorslaer E, Watanabe N. 2003. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *Journal of Econometrics* **112**: 207-223

Table 1: Decomposition of Income-related Concentration Index (CI)

Variable	$\hat{\beta}_k$		C_{kt}			$\xi_{kt} = \hat{\beta}_k \overline{w}_{kt} / \overline{h}_t$			$\hat{I}_{kt}$		
	coef.	s.d.	CDS-I	CDS-II	CDS-III	CDS-I	CDS-II	CDS-III	CDS-I	CDS-II	CDS-III
African-American	-0.466***	(0.056)	-0.437	-0.417	-0.475	-0.033	-0.032	-0.028	13.73%	13.77%	12.68%
Latino	-0.561***	(0.098)	-0.412	-0.473	-0.339	-0.032	-0.035	-0.040	12.42%	17.17%	12.56%
Log Family Income	0.138***	(0.026)	0.385	0.299	0.306	0.091	0.106	0.109	32.92%	32.39%	31.18%
Child lives with both parents	0.116*	(0.050)	0.159	0.164	0.173	0.044	0.040	0.038	6.52%	6.65%	6.22%
Mother some college	0.325***	(0.080)	0.103	0.085	0.047	0.044	0.046	0.046	4.28%	3.96%	2.05%
Mother college graduate	0.419***	(0.100)	0.479	0.419	0.508	0.033	0.035	0.038	14.94%	15.12%	17.99%
Mother post graduate	0.344**	(0.122)	0.454	0.491	0.534	0.012	0.012	0.013	5.17%	6.26%	6.68%
Low birth weight	-0.238**	(0.077)	-0.166	-0.154	-0.461	-0.008	-0.007	-0.008	1.23%	1.12%	3.48%
CI of child health			0.107	0.097	0.107						

Note: Table 1 shows decomposition results for a subset of covariates used in the model. The CI of child health is the estimate of the income-related concentration index that we decompose. The full list of covariates in the regression and decomposition includes: log family income, age, age square, child gender, child race/ethnicity (African-American, Latino, Other), number of children in the family, child lives with both parents, mother's age when child was born, child lives in metropolitan area, smoking in the family unit, child has any kind of health insurance, mother is high school graduate, mother has some college education, mother is college graduate, mother is employed, mother is retired/temporarily laid off/sick leave or maternity leave, mother is a student or homemaker, mother has other employment status, primary care-giver is not mother, primary care-giver is female, child has at least one chronic health condition, child born with low birth weight. $\hat{\beta}_k$ is the coefficient of each covariate in the regression. C_{kt} is the income-related concentration index of the covariate. ξ_{kt} is the elasticity of the covariate, and $\hat{I}_{kt}$ is the percentage contribution of the covariate to the income-related health inequality.

Table 2: Decomposition of Changes in Income-related Health Inequality

Variable		
	(1) CDS-II	(2) CDS-III
Concentration index in the final period (CI^f)	0.098	0.107
Concentration index in the initial period (CI^s)	0.107	0.107
Concentration index of the final period health ranked by initial income (CI^{fs})	0.088	0.095
Average health change ($\overline{\Delta h}$)	0.017	0.012
Final period average health ($\overline{h}^f$)	0.606	0.600
Concentration index of health changes ranked by initial income ($CI^{\Delta s}$)	-0.522	-0.960
Income-related health mobility (M^H)	0.019	0.012
Progressivity index *P*	0.629	1.067
Scale factor *q*	0.028	0.020
Health-related income mobility (M^R)	0.010	0.012

Note: Table 2 shows decomposition of changes in the cross-sectional CI from CDS-I to CDS-II (column 1) and from CDS-I to CDS-III (column 2).